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ART. IV.—*Chronology of the Reigns of Tiglath Pileser, Sargon, Shalmanezer, and Sennacherib, in connexion with the phenomenon seen on the Dial of Ahaz.* By J. W. BOSANQUET, ESQ.

[*Read the* 8*th July,* 1854.]

No one who takes interest in the discoveries daily made in Assyria and Babylonia can fail to have read the interesting and important communications from Colonel Rawlinson, which appeared in the Athenæum of the 18th March and 15th April last, conveying to the public a mass of new and most valuable material towards framing a continuous chronology of the Assyrian and Babylonian empires, even from their earliest origin: establishing the fact that Semiramis, queen of Babylon, was the wife of Pul, king of Assyria; and mentioning the discovery of Belsharezar son of Nabonidus, whom he supposes to be the Belshazzar of Scripture, and the last of the kings of Babylon.

All, I presume, will be inclined to agree with Colonel Rawlinson in his conclusions with regard to the date of the reigns of Pul, Semiramis, and Tiglath Pileser; and his discoveries indeed lead to the establishment of a most important synchronism between Assyrian, Babylonian, and Jewish history at that period. But I cannot assent to the possibility of Belsharezar *son of Nabonidus*, being the king so distinctly described in Scripture as the *son* or lineal descendant *of Nebuchadnezzar,* king of Babylon. My object at present, however, is to direct attention to one portion of Colonel Rawlinson's communication in particular, viz., that which relates to the reigns of Sargon, Shalmanezer, and Sennacherib, concerning which I am compelled to differ from him materially.

It may be thought rash, perhaps, in one who does not pretend to interpret the Assyrian inscriptions, to dispute the correctness of conclusions derived by Colonel Rawlinson from the actual reading of those inscriptions. Nevertheless, if it can be shown that his conclusions are at variance with what is written in the contemporaneous Hebrew records, which treat of the same times and the same persons, and which, taken merely as historical writings, have been preserved with more scrupulous care than any other writings in existence—and also that they are confessedly at variance with some of the facts derived from the monuments themselves—reasonable doubts may be entertained whether the evidence to be drawn from Assyrian monuments is yet so complete, as to enable even those who interpret them to feel confidence in their own chronological deductions. I propose therefore to show—

1st. That Colonel Rawlinson's chronological arrangement of the reigns I have referred to cannot be made to harmonize, either with the contents of the Hebrew Scriptures, or with the facts deduced by him from the Assyrian monuments.

2nd. It is the particular object of this paper to draw attention to the fact, that the third year of the reign of Sennacherib is associated in history with a most remarkable astronomical phenomenon, the date of which is capable of being fixed with mathematical precision: and that the date so determined fixes the third year of Sennacherib to the twelve months beginning in the spring of B.C. 690, and ending in the spring of B.C. 689, about ten years later than the date assigned by Colonel Rawlinson, viz., B.C. 700.

The difference apparently is small between us; yet the results are most important. His view of the reigns tends to establish the correctness of the received chronology, which involves, as I have elsewhere shown, a continuous series of discrepancies between sacred and profane history: mine to subvert some of the principal dates upon which that system is established, by lowering the whole scale of Hebrew kings to the extent of about twenty-eight years: thereby introducing a scheme of chronology resting chiefly on the authority of the Hebrew Scriptures, which Scriptures I am prepared to show contain a consistent system of dates, for a thousand years upwards from the birth of Christ, more perfect than can be drawn from the records of any heathen nation whatever, at least as they are at present understood.

In the Athenæum of the 18th of March, Colonel Rawlinson states that Sennacherib reigned for 22 years. "This number," he says, "I have found upon a clay tablet—and the canon, therefore, is rigidly correct in assigning the year B.C. 680 as the date of Esarhaddon's accession to the united throne of Assyria and Babylonia," (p. 343); and in the Athenæum of the 18th February, Sennacherib is said to have ascended the throne in B.C. 702, (p. 216). The dates of the commencement of the several reigns we are considering are thus placed:

Tiglath-Pileser	B.C. 746	16 years.
Shalmanezer	730	9 „
Sargon	721	19 „
Sennacherib	702	22 „
Esarhaddon	680	

Now this arrangement of dates involves a complete dislocation of events as recorded in the Hebrew annals, and on the Assyrian monuments themselves, as may be clearly seen by reference to the accompanying chronological table. Let us first examine the correctness of his date for the reign of Sennacherib. Colonel Rawlinson appears to place too little confidence in the accuracy of the monuments, and contemporaneous Hebrew writers; and to pay too much deference to the conventional dates of the commonly received chronology, which rest, I maintain, upon no really solid foundation. He finds, for instance, in the annals of Tiglath Pileser that, in the eighth year of that king's reign, tribute was paid to him by Menahem, king of Samaria. But, instead of taking the fact as it is recorded, and from thence correcting his chronology, his system leads him to suggest "that in this passage the name of Menahem has been improperly used for that of Pekah," (p. 343), who reigned later in the list of kings.

This precious fact, however, that Menahem paid tribute to Tiglath Pileser in his eighth year, coupled with another fact, mentioned in the xvth chapter of the II. book of Kings, viz., that "Menahem gave Pul one thousand talents of silver, that his hand might be with him, to confirm the kingdom in his hand," affords the means of fixing with precision the position of the reign of Menahem, with relation to that of Pul and Tiglath Pileser—for Menahem reigned only ten years; and since eight of those ten years, at least, were contemporary with the first eight years of Tiglath Pileser, he could not have begun to reign till the close of the reign of Pul.

Let us count then the years of
Menahem . . . 10
Pekahiah . . . 2
Pekah 16
as kings of Samaria:
when in the 17th year of Pekah,
Ahaz began in Jerusalem his reign of . 16 years, followed by
Hezekiah, who reigned . . . . 13 full years, till
the invasion of Sennacherib, 57

Thus making a period of exactly fifty-seven years from the first year of Menahem, or the last year of Pul, to the time of the invasion of Judæa by Sennacherib. If then we can ascertain the date of the last year of the reign of Pul, we shall at the same time determine the date of Sennacherib's invasion, which we know from his own annals to have taken place in his third year.

Now the noble discovery recently announced by Colonel Rawlinson, that Semiramis, the founder of Babylon, was "queen of the palace of Phuluka," king of Nineveh—the Φαλωχ of the LXX, and Pul of the Hebrew Scriptures—guides us to the point of our search with much accuracy. For the most consistent account of Semiramis is, that she was[1]

1st. Mistress, then wife, of the king of Assyria (Pul.)
2nd. That she obtained possession of the government for a few days; imprisoned her husband, and then slew him.
3rd. That she married her own son.
4th. That she transferred her government to Babylon.
5th. And she reigned, according to Herodotus, in Babylon, five generations before Nitocris. (Herodotus, l. i. 184—188).

Nitocris, we are informed by Herodotus, was wife of that king, called Labynetus, who witnessed the eclipse of Thales in the year B.C. 585. Soon after the date of the eclipse Nineveh was conquered by Cyaxares, king of the Medes; and Herodotus adds that Nitocris, seeing that the power of the Medes was increasing, and that they *had taken Nineveh*, began to fortify Babylon with dykes and walls. Nitocris then was reigning in Babylon about the year B.C. 582, or three years after the eclipse of Thales; and if we add 155 years, or five generations according to Herodotus, to that date, we come to the year B.C. 747 for the reign of Semiramis; that is to say, to the first year of the well-known Babylonian era which dates from Nabonassar. Semiramis, therefore, was probably the wife of Nabonassar. There is some reason also for believing that Nabonassar was her own son, for Syncellus and Cedrenus say that Nabonassar was also called Shalmanassar; and Colonel Rawlinson has found a slab with an inscription, which may be interpreted "Shalmanezer, son of Pul." Be this, however, as it may, Semiramis was certainly reigning at Babylon about the year B.C. 747; and we can hardly doubt the inference drawn by Colonel Rawlinson, that the date of the transition of the government under Semiramis from Nineveh to Babylon, and of the murder of her husband Pul, was at that particular epoch. I therefore adopt Colonel Rawlinson's dates, B.C. 747 for the last year of Pul, and 746 for the first year of Tiglath Pileser.

Now if we count 57 years from the last year thus ascertained of the reign of Pul, it brings us to the year B.C. 689 or 890 for the time of Sennacherib's invasion, which is the point we were in search of. This conclusion is definite and precise. That it is also accurately correct, may be shown by three other independent modes of proof.

1st. The Jewish historian Demetrius, quoted by Clemens Alexandrinus, as I have repeatedly pointed out, writing two hundred years before Christ, when the true dates of the several captivities of the people of Judah and Israel could hardly have been lost, has expressly fixed the date of the deportation of Jewish captives, or retreat from Judæa by Sennacherib, to February, B.C. 688, and his taking of the fenced cities, we may infer occupied the whole of B.C. 689, and part of the preceding year. Nebuchadnezzar, he tells us, carried away the Jews from Jerusalem 338 years and three months before the reign of Ptolemy Philopator, and Sennacherib carried away some captives 128 years and six months before that time. Ptolemy Philopator began to reign in Egypt in November, B.C. 222; counting therefore 338 years and three months from that date brings us to August, B.C. 560, for the taking of Jerusalem by Nebuchadnezzar; and 128 years and six months added again to that date, brings us to February, B.C. 688, for the carrying away of the captives by Sennacherib.

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[1] Volney's Recherches Nouvelles. Part iii, p. 79.

Whether we count downwards, therefore, from the reign of Pul, or upwards, from the reign of Philopator, we are led to the same date (B.C. 689) for the invasion of Sennacherib.

2nd. We have a most stringent test of the accuracy of the date, arising out of the words spoken to Hezekiah during the time when Sennacherib was taking the fenced cities of Judæa, and threatening Jerusalem. He was told that Sennacherib should not succeed in taking Jerusalem; and "this shall be a sign unto you, ye shall eat this year such things as grow of themselves, and in the second year that which springeth of the same: and in the third year sow ye and reap, and plant vineyards, and eat the fruits thereof;" thus implying two successive years of fallow at that time, as commanded by the law of Moses, in the Sabbatical year, and the year of Jubilee, which could only take place once in every fiftieth year. Now, B.C. 689-8 is a Sabbatical year in the regular septennial series, counted from three known years mentioned by Josephus; and B.C. 688-7 is also a year of Jubilee in regular series, when we place the fourteenth year of Hezekiah in B.C. 689.[1]

3rd. I shall presently show that the celestial phenomenon to which I have alluded, as occurring about this time, marks to a day the time of Hezekiah's recovery from his sickness as the 11th January, B.C. 689; and the sickness, we are told, was about the time of Sennacherib's invasion.

The year B.C. 689 thus forms a cardinal point in my proposed arrangement of the kings of Assyria about this time; and I am not aware of any discrepancy whatever between Scripture and the monuments, which arises out of this arrangement.

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[1] See my recent publication, "Sacred and Profane Chronology," on the subject of the Sabbatical year and Jubilee.

On the other hand, Colonel Rawlinson's arrangement is at variance with the inscriptions, inasmuch as he places the first year of Menahem in B.C. 770, more than twenty years before the accession of Tiglath Pileser, who took tribute of him, and reigned eight years concurrently with him.

It is at variance with the Hebrew records, inasmuch as they inform us that Shalmanezer was reigning in the sixth year of Hezekiah, and Sennacherib in his fourteenth year; that is to say, that Shalmanezer and Sennacherib reigned within eight years of each other; whereas he places the reign of Sargon, which lasted nineteen years, between the reigns of Shalmanezer and Sennacherib—and again, the fourteenth year of Hezekiah is made by him to fall in the reign of Sargon, instead of that of Sennacherib, and the invasion of Sennacherib to fall in the twenty-ninth year of Hezekiah, instead of his fourteenth.[1]

The record of Scripture is also set at variance with the record of the monuments, inasmuch as Merodach Baladan, *son of Yagin*, of the inscriptions, is made to represent the Merodach Baladan of Scripture, who sent messengers to Hezekiah, and who is expressly described in the passage as the *son of Baladan*, probably to distinguish him from this son of Yagin, who indeed may have been his father.

Lastly, the year of Sennacherib's invasion of Judæa, according to Colonel Rawlinson, does not fall in a Sabbatical year.

These contradictions are too glaring and too numerous to leave it possible that Colonel Rawlinson's arrangement can be the true one; and I submit the following as more in accordance with facts:

Tiglath Pileser . . .	B.C. 746	reigns 31	years.
Sargon	721	" 19	"
Shalmanezer	702	" 11	"
Sennacherib	692	" 25	"
Esarhaddon, in Babylon	680	" 13	"
" in Nineveh	667		

There are two points in this arrangement to which it is right that I should draw attention: 1st, That Shalmanezer follows Sargon, instead of preceding him, as in Colonel Rawlinson's scheme. 2nd, That the reigns of Tiglath Pileser and Sargon necessarily overlap each other to the extent of six years.

With regard to the first point, I am aware that Sargon was father of Sennacherib, and that Colonel Rawlinson has stated that Sargon was succeeded immediately by his son. As the reasons for this statement, however, have not been made public, and the result is so decidedly contradictory of the Hebrew annals, I venture to disregard them, in the expectation that they are in some way based upon inferences drawn from what I am here contending to be a false arrangement. With regard to the overlapping of the two reigns of Tiglath Pileser and Sargon, so far from being an objection, it affords an additional confirmation of the correctness of my arrangement, for in the Transactions of the Royal Irish Academy, vol. 22, p. 366, Dr. Hincks has pointed out a passage in Monsieur Botta's inscriptions, 74, 3, in which the predecessor of Sargon on the throne of Assyria is alluded to as still alive in the sixth year of Sargon's reign. Sargon also appears not to have styled himself king of Assyria in the early part of his reign; that is, I infer, while Tiglath Pileser was still alive and on the throne. That the two kings were reigning in joint sovereignty at this time, I conceive to be implied also by these words in the II. Chronicles, xxviii., 16: "At that time did Ahaz send unto the *kings* of Assyria to help him." In all other places the king of Assyria is spoken of. This passage implies that more than one king was then on that throne. Now Ahaz, according to the table, began to reign in the third year of Sargon's joint reign with Tiglath Pileser.

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[1] Dr. Hincks takes the same view as Colonel Rawlinson. See Trans. Royal Irish Academy; vol. xxii, p. 369; and Journal of Sacred Literature, No. xii.

I now proceed to show, that there is an extraordinary solar phenomenon attached in history to the third year of the reign of Sennacherib, or the year of his invasion of Judæa, the date of which, owing to recent improvements in astronomical tables, is now capable of accurate determination; and which, when determined, perfectly confirms the result just arrived at, as regards the reign of Sennacherib.

We learn from the book of Isaiah, that about the time when Sennacherib first invaded Judæa, that is to say before[1] the appearance of Rabshekah before Jerusalem which terminated the invasion, Hezekiah, king of Judah, was "sick unto death." He prayed that he might be restored to health; and the prophet was sent to him to say, in the words of our authorized version of the text: "Thus saith the Lord. Behold, I will add unto thy days fifteen years. And I will deliver this city out of the hand of the king of Assyria: and I will defend this city. And this shall be a sign unto thee from the Lord, that the Lord will do this thing that he hath spoken; Behold I will bring again the shadow of the degrees which is gone down in the sun-dial of Ahaz, ten degrees backward. *So the sun returned ten degrees, by which degrees it was gone down.*"

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[1] Isaiah, xxxviii., 6.

In another place[1] we are told, with reference to this extraordinary event, that the princes of Babylon sent messengers to Jerusalem, "*to inquire of the wonder done in the land.*" From this last fact it is clear, that on the occasion of the going back of the shadow on the dial, some phenomenon also of a public and extraordinary character had been witnessed in the heavens by the people in general of the land of Judæa, the rumour of which had been carried to Babylon, either by some of the army of Sennacherib who had seen it, or by some of the Jewish captives in that army. It is not probable that the event would have been reported at Babylon had it been merely of a private nature, limited to the palace of Hezekiah, and attested by the sole evidence of a sick and dying man. We cannot doubt then that the sun itself was affected in some manner visible to the multitude of Judæa, and also to the invading army, while the particular dial of the palace was affected in the manner witnessed by the king : there was a two-fold exhibition of the phenomenon.

Various interpretations have been put upon this remarkable event in Jewish history by different writers. Costard, in his Astronomy, and the Abbé Halma, in his Preliminary Discourse on Ptolemy's Hypothesis of the Planets (p. 21), have suggested that the words were fulfilled, by Hezekiah living on to the next day, and so seeing the return of the shadow on the dial to the same point from which it had gone down on the previous day. Such, however, cannot be the explanation : for clearly the princes of Babylon would not have sent to Jerusalem to inquire concerning such an event, nor would any "wonder" have thus occurred in the land.[2]

Hippolitus considered that the day when the event took place was miraculously lengthened to the extent of thirty-two hours ; while Eustathius argued that the length was only twenty-two ; and some are still disposed to infer that the diurnal rotation of the earth was supernaturally reversed on the occasion. Far be it from me to deny that the course of nature may have been suspended on this occasion, if required by the circumstances : but it may be observed that we are not led by the accompanying facts to expect a miracle. The king, who was afflicted by a grievous boil, was recovered not miraculously, but by the ordinary application of a lump of figs to the spot : a process of healing used in the East to this present day. If the diurnal motion of the earth had been reversed, a visible wonder indeed would have been performed in the land of Judæa ; but equally so in all other parts of the world.

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[1] II. Chronicles, xxxii. 31.

[2] See also Montucla's Histoire des Mathématiques, p. 737 ; Sur le phénomène de la rétrogradation de l'ombre dans un cadran solaire.

There would have been no more need to send to Jerusalem concerning it than to any other country. We may be quite certain, however, that no such interference with the ordinary course of nature did take place, because in the several eclipses of the moon observed at Babylon, both before and after this event, the times of which are accurately recorded in Ptolemy's Almagest, the conjunctions of the sun and moon are found to have followed their ordinary course without disturbance, which could not have been the case had the sun receded ten degrees in any one year.

An extraordinary refraction of the sun's rays has been supposed by some to have been the mode of producing the effect: and doubtless a dial might be affected in the way described by such a cause: but here again it may be observed that no celestial wonder would have been exhibited to the people of which the rumour could have travelled to Babylon.

The only mode of affecting the solar rays in the twofold manner described, in the ordinary course of nature, openly exciting on the one hand the wonder of the multitude, and on the other privately affecting a dial in the palace of the king, would have been by the occurrence of a solar eclipse.[1] Many instances are on record of the surprise and even terror in those days produced by such a phenomenon. I shall endeavour presently to point out the manner in which the shadow on a dial might be affected by an eclipse. There is strong *primâ facie* reason therefore for inferring that the phenomenon witnessed in Judæa and Jerusalem about the fourteenth year of Hezekiah was nothing more nor less than an eclipse of the sun.

This inference is strengthened by the fact that the Chaldæan astronomers of that particular time were in the habit of minutely registering the times and appearances of the eclipses of the sun and moon. Isaiah, speaking of the Babylonians, in the time of the reign of Sennacherib, calls them astrologers, stargazers, and monthly prognosticators: and we have still extant in Ptolemy's Almagest the record of two eclipses of the moon in the years B.C. 721 and 720, observed at Babylon only thirty-two years before the fourteenth of Hezekiah. Nothing more natural, therefore, than that the Babylonian astronomers should have desired to be informed concerning the rare appearance of such an eclipse as we shall find took place at the time.

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[1] The idea that the appearance on Hezekiah's dial may have been the effect of an eclipse was, I believe, first suggested by Thenius, in his Chronological Survey of the History of the Israelites, though I have not seen the work. See Gumpach's Zeitrecknung der Babylonier und Assyrier, p. 134, note.

If we are justified in our inference thus far, we may proceed a step further, and infer the particular character of the eclipse, which, if eclipse there was, must then have occurred. There are but three forms of solar eclipse—total, annular, and partial. We may conclude with certainty that it was not of the awful character of a total eclipse, during which we know that instantaneous change from light to darkness takes place, producing the most appalling effect in nature. Mr. Airy observes concerning a total eclipse: "The phenomenon is one of the most terrible that man can witness; and no degree of partial eclipse gives any idea of its horror."[1] Had such a darkness taken place doubtless it would have been the chief incident dwelt upon in the description. The incident dwelt upon, however, is the extrordinary deflection of the sun's rays upon the dial, which implies an eclipse of the greatest magnitude short of total—one during which the light of the sun was not extinguished, but yet of that magnitude that the shifting of the source of light, during the progress of the moon over the sun's disc, would sensibly affect the shadow on a dial. It was not therefore total. That it was not an annular eclipse, we may also infer from the fact, that the shadow was deflected, not horizontally, but in a vertical direction. This will appear from a consideration of the original passage, in which we shall find no such word as "dial" in the Hebrew. The motion of the shadow was exhibited upon steps. The literal translation of the passage runs thus: "Behold I will bring back the *shadow of the steps* which it shall have gone down on the steps of Ahaz with the sun, backwards ten steps. And the sun shall be turned back ten steps, on the steps which it shall have gone down." The Targum of Jonathan on the passage, the oldest paraphrase, calls it the *ascent* (or steps) of Ahaz; and Glycas, a Byzantine writer, says, that the tradition was, that Ahaz had formed a certain instrument in the shape of steps to mark the hour of the day. The expression "shadow of the steps," or "shadow of the degrees," as it is commonly translated, cannot be mistaken; for no shadow could be thrown by degrees of a graduated scale unless raised in the form of steps. The Hebrew word *Maaloth* also implies "ascent," as translated in the Targum.

We thus learn that it was upon a flight of steps that the motion of the sun's shadow was seen to go back on this occasion; and here we may remark upon the particular propriety of the sign, as given in answer to the inquiry: "What shall be the sign that I shall *go up* into the house of the Lord?" that is, that I shall ascend the steps of the temple. The answer is: "I will bring again the shadow of the steps which it is *gone down*, ten steps backward;" that is, the shadow shall ascend ten steps. There would be no connection between these words and the inquiry if understood as referring merely to degrees on a scale. But the only use of steps would appear to be to mark the vertical motion of the sun; and the use of such an instrument, if indeed it was more than an ordinary flight of stairs, we may infer, would have been merely to mark the meridional altitude of the sun from day to day, or the dip at noon day. Now the different phases of an annular eclipse would produce no sensible effect in a vertical direction on a flight of steps. The eclipse, therefore, could neither have been total, nor annular, but must have been a very large partial eclipse; and as the effect was to cause the shadow to "go down" the steps, the eclipse must have been upon the upper limb.

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[1] Lecture on the eclipse of Thales.

These indications of the character of the eclipse to be looked for in the year B.C. 689, are sufficiently particular to distinguish it from any other solar eclipse within many years of that time. So large a partial eclipse as this must have been, of the upper limb of the sun, visible at any particular spot on the earth, is an event of rare occurrence. There is, however, another peculiar mark attached to it, which, coupled with those mentioned, would distinguish it from any other eclipse which could have occurred within many hundred years, viz., the time must have been very close upon noon-day. We are told that the shadow went back ten steps, by which it had gone down on the steps of Ahaz. The sun, or the shadow, had, therefore, descended ten steps from its extreme altitude, and was brought back again to its meridional altitude for the day.

We look, therefore, for a large partial solar eclipse, on the upper limb, visible at Jerusalem, about twelve o'clock, on some day in the year B C. 689.

Now by the kindness of the Astronomer Royal, whom I do not intend to implicate in any way with my view of the question, I am enabled to show, that an eclipse of the sun, corresponding in every particular with what is required, excepting only the exact time of day, occurred in the year B.C. 689: and, with regard to the time, it is an extremely interesting fact, that astronomers are at this moment engaged in calculations which will probably alter the computed time of this particular eclipse to the extent of about half an hour, which would bring the computed time within about fifteen minutes of the time required by the history.

Mr. Airy writes: "The eclipse of B.C. 689, January 11, was annular, and the annulus was rather broad. The sun's apparent diameter was 16′ 13″, and the moon's (in the neighbourhood of Jerusalem) was 15′ 13″.

"The course of the central line of shadow, with Greenwich Elements, is defined by the following points:

Longitude E.		Latitude N.		Apparent time at the place.	
21°	43′	35°	3′	21h	36m
30	12	34	52	22	30
37	8	36	37	23	18
44	10	40	11	0	5
53	26	46	37	1	3

"It passes through Issus. I have not computed the breadth of the annular zone upon the earth, but I can see that the eclipse would be as nearly as possible just annular at Jerusalem, perhaps sensibly annular, perhaps not quite annular.

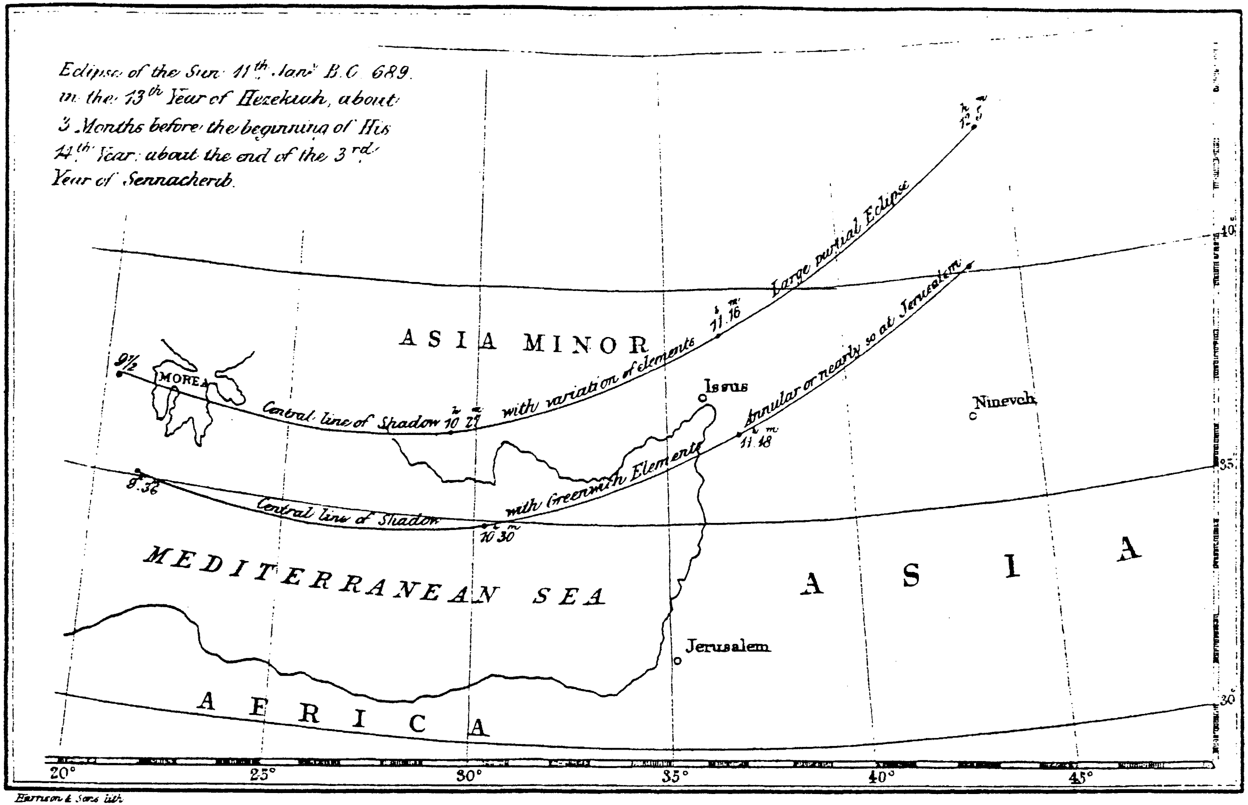
"With variation of Elements (using the word in the technical sense of my paper) the course is

Longitude E.		Latitude N.		Apparent time at the place.	
20°	18′	37°	14′	21h	30m
29	23	36	51	22	27
36	40	38	37	23	16
44	1	42	24	0	5
54	12	49	28	1	6

"In this, which is the more probable course, the eclipse would not be annular at Jerusalem, but it would be a very large eclipse."

Thus we find that there was an eclipse of the sun in the year B.C. 689, visible at Jerusalem, about three months before the commencement of the Jewish year, (from which point the years of the reign of the kings of Judah were always counted), which was either annular or partial on the upper limb, and that the computed time of central conjunction at Jerusalem is about ten minutes past eleven o'clock, which is much too early; since the sun's motion in altitude at that time of day would have been too rapid for counteraction by the deflection of its rays in a direction opposite to its motion by any eclipse which could take place.

Mr. Adams, however, writes to me that calculations are now being carried on by himself and Professor Hansen, the effect of which, as far as they have proceeded, is to diminish the longitude of the moon in the year B.C. 689 nearly 930″, making an eclipse at that time nearly



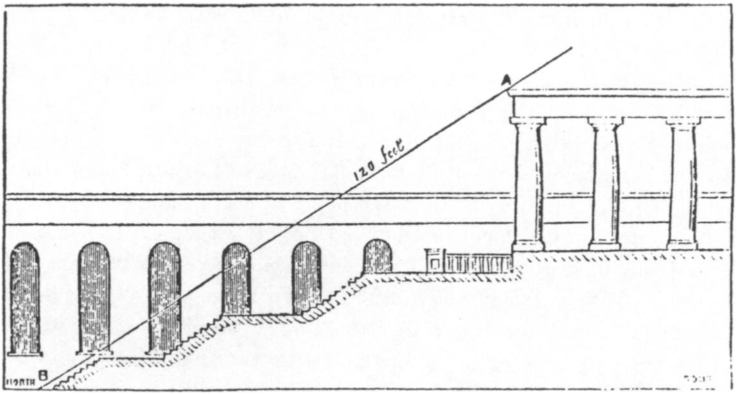
Eclipse of the Sun 11th Jany B.C. 689.
in the 13th Year of Hezekiah, about
3 Months before the beginning of His
14th Year: about the end of the 3rd
Year of Sennacherib.

Harrison & Sons lith.

half an hour later. This is coming very near the extent of correction required. There is still about another quarter of an hour required to bring the historical and computed time to coincide; and I cannot but feel sanguine that ultimate agreement will be produced, either by correction of my view of the exact time required, or by correction of the elements of the computation.

It now remains for me to point out the mode in which the appearance of the going down and return upwards of the shadow caused by the eclipse could have been exhibited to Hezekiah on the "steps of Ahaz." I shall endeavour to show that the phenomenon may have been witnessed, either in open day on the ordinary steps of the palace, or on some horologial instrument in the private apartment of the king.

The "city of David," and the "house of David," the palace where Hezekiah probably dwelt, we know was situated on a hill at the south of Jerusalem, ascended by stairs from the lower city, called "the stairs (*maaloth*) of the city of David." (Neh. xii. 37.) We may reasonably assume also that there were steps leading up to the entrance of the palace, and also within the great court, perhaps somewhat thus:



Let us suppose the steps to have sloped upwards from north to south, at an inclination of from 32° to 34°, say at 32°, or a rise of seven inches in a foot, the ordinary inclination of a flight of steps; and let us suppose a line drawn from the top of the building at A to the pavement beyond the lowest step at B, to be a length of 120 feet, inclined at an angle of 35°.

We will next observe the altitude of the sun at Jerusalem for thirty days before and after the winter solstice, and for an hour before and after noon-day on the 11th of January, B.C. 689, from data for which I am also indebted to the kindness of Mr. Airy;

"The shortest day in B.C. 690 was December 28, (Julian). The meridian altitude of the sun at Jerusalem on that day was 34° 25′

ten days later (or earlier)	34	27
twenty days later (do.)	35	53
thirty days later (do.)	37	45

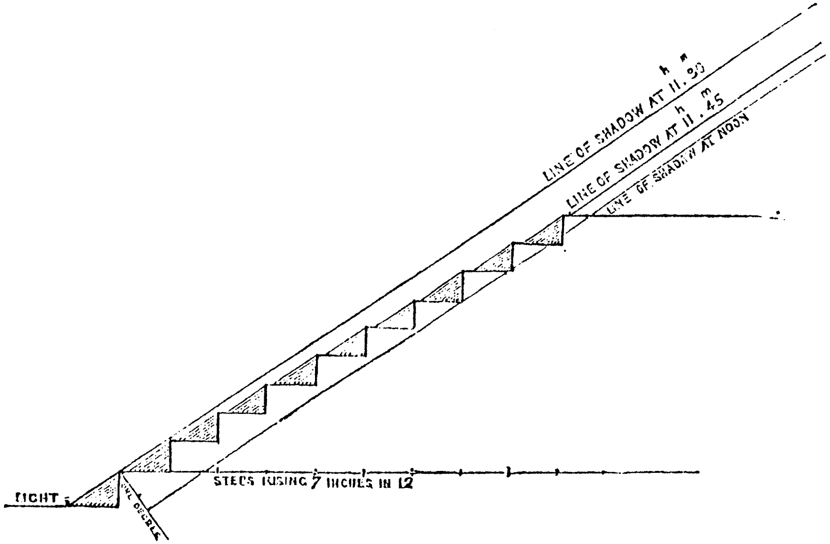
The altitude of the sun on the 11th of January, at each ten minutes before and after 12 o'clock :

11^h 0^m	33°	20′	1^h 0^m
11 10	33	54	12 50
11 20	34	22	12 40
11 30	34	43	12 30
11 40	34	59	12 20
11 50	35	8	12 10
Noon	35	11	Noon.

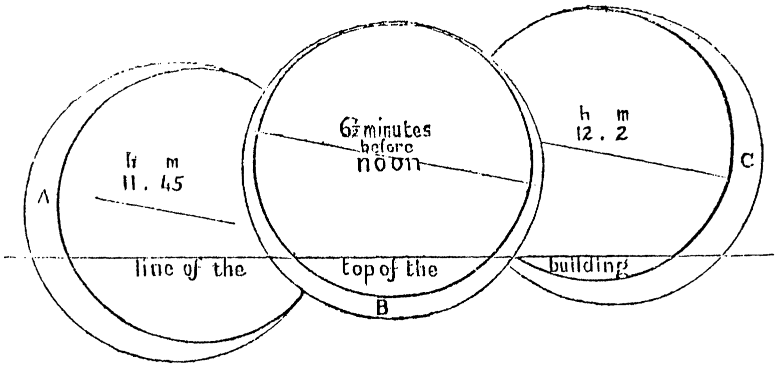
On B.C. 689, morning of 11th January, the moon's relative hourly motion in declination was 5′ 44″ northward ; and that in right ascension was 29′ 33″ eastward. These are geocentric motions. For the apparent motion at Jerusalem, the motion in declination will be little altered : that in right ascension will be diminished by nearly $\frac{1}{3}$ part, or about $\frac{2}{7}$."

Now, as the sun's semidiameter was 16′ 13″, and the centre of the sun had risen on the 11th January to an altitude of 34° 43′, at 30 minutes past 11 o'clock, the upper rim of the sun's disc at that time would have reached the altitude of 34° 59′ 13″, or just below the top of the building A, viewed from the point B, casting the shadow of the building on the pavement just beyond the lowest step. In the course of half an hour the centre of the sun would have slowly risen to its extreme altitude for the day, 35° 11′, the upper rim of the disc to 35° 27′ 13″, and the lower to 34° 54′ 47″, or 5′ 13″ below the top of the building, casting a line of shadow on the steps at an angle with the line A B of 27′ 13″, or rather less than half a degree ; and as 120 feet is the radius of a circle which gives two feet to a degree, it is clear that light would be spread over a space of somewhat less than one foot inwards from the lowest step ; thus illuminating the whole of the lower flight of ten steps, and a portion of the first landing ; the top of each step being in light, and each step also casting its own shadow on the step below, as expressed by the words, "shadow of the steps," as delineated on the opposite page.

We will now suppose the king to have been watching from a side chamber in the court the gradual movement of the shadow up the steps, for fifteen minutes, from 11^h 30^m ; during which it would have


LINE OF SHADOW AT 11h 30m
LINE OF SHADOW AT 11h 45m
LINE OF SHADOW AT NOON
STEPS RISING 7 INCHES IN 12
LIGHT

passed over about 22′, bringing the shadow above the tenth step at 11^{h} 45^{m}. During these fifteen minutes it is obvious that the upward motion of the sun would counteract any motion of the point of light in the opposite direction, which could be caused by an eclipse: from which we learn that it is at near noon-day alone, on the particular day, that the shadow could have been affected by such an event: at a quarter before 12 o'clock, however, on that day, the sun's motion in altitude became greatly diminished, rising only about 6′ in fifteen minutes. At about this time, then, (being a quarter of an hour later than astronomers have yet found by computation), I consider the centre of the moon to have advanced over the sun's disc to the position represented in figure A, producing a partial eclipse.



The rays of light proceeding from the upper part of the crescent would now tip with light the tenth or top step, and the progress of the shadow would there be arrested. In the course of about 8½ minutes more, or at 6½ minutes before noon, the eclipse would have assumed the form B. The two divided rims of light on each side would cast no sensible shadow, and the mass of light producing shadow would proceed from a point somewhat above B, from about the level of the line of the building, causing the shadow to descend to the lowest step.

Let us now suppose the prophet to have been in conversation with the king, during the preceding ten minutes, delivering the divine message, informing him that he shall recover from his sickness and yet live fifteen years. The king exclaims, "What shall be the sign," &c. "And Isaiah said, This sign shalt thou have of the Lord, that the Lord will do the thing that he hath spoken." (I follow Walton's translation). "The shadow hath departed ten steps, if it should return ten steps?" or, following the usual construction of the passage, speaking when the shadow had just begun to go down, "Shall the shadow go forward ten steps, or shall it go back ten steps?" Either effect would be sufficiently striking to a daily observer of the mid-day shadows, considering the rapidity of the movement, compared with the ordinary rate of motion of the shadow about noon day. The king, however, having watched the shadow to the lowest step, exclaims, "It is a light thing for the shadow to go down ten steps: nay, but let the shadow return backward ten steps. And Isaiah the prophet (quite as ignorant as the king of the natural cause of the event) cried unto the Lord; and he brought back the shadow ten steps backward, by which it had gone down on the steps of Ahaz." The third position of the eclipse now gradually comes on, and the shadow returns to the upper step from which it had gone down, and continues there for more than ten minutes.

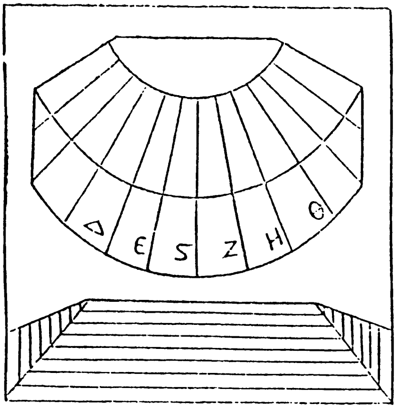
Such must have been the effect produced upon any conformation of building and steps such as I have described, in any part of Jerusalem, on the 11th January, B.C. 689, provided the time of the eclipse at that period can be placed somewhat later than the time computed; and such I believe to be the nature of what was actually witnessed by Hezekiah. The duration of the phenomenon was sufficient to have left an impression on the king's mind, free from all doubt, as to the marvel that had occurred; and the deep conviction must have followed, that the superhuman intelligence which alone, in those days, could have foreseen the event, could indeed foresee, and make good the promise conveyed to him, that he should yet survive for fifteen years.

It may be further observed, that if this phenomenon was really witnessed on an ordinary flight of palace steps, at an inclination of not more than 34°, it is probably the only occasion on which it could have been witnessed in Jerusalem. A large partial eclipse of the particular form required is of sufficiently rare occurrence at any one spot, as we have already observed, and such an eclipse within a few minutes of noon-day a still less frequent occurrence ; but if, in addition to these two requirements, we have to combine the further condition, that it shall occur at a period of the year when the sun's altitude is sufficiently near 34° to produce the effect, which could only be the case at Jerusalem within about twenty days on either side the winter solstice, we have a combination of conditions which we may safely say has not occurred a second time at Jerusalem, in any of the solar eclipses since visible at that spot. Yet such a combination appears to be required by the history, and also to have taken place.

But perhaps it may be thought improbable that this scene should have occurred at all in the open court of the palace. The king was sick, and at the point of death. It is said that he turned his face to the wall, probably turning on his couch, from which he was unable to move ; and the dial of Ahaz may have been, as the tradition has it, an instrument invented by that king. If so, it is quite clear that the same phenomenon may have been witnessed on a minute scale, in a chamber, on a small instrument, with the same precision as we have seen it might have been witnessed on the palace steps, on a large scale.

In the absence of clocks, it was of extreme importance to the ancients, to be able to fix with exactness some one point of time in the day ; and, for this purpose, they were in the habit of carefully observing the turn of the sun's shadow at noon-day, the only time which could be marked with precision by the shadow. This daily habit of observation must have made them perfectly cognizant of the rate of motion of the shadow about that hour, and extremely sensitive of the slightest variations in the motion from day to day. We know that they had invented various instruments for the purpose of marking the shadows. There was the Pole and Gnomon, mentioned by Herodotus, which marked the progress of the shadow throughout the day, the Pole being of the form of a hollow bowl or hemisphere. The Obelisk was no doubt employed to mark the length of the sun's shadow from hour to hour. The Heliotropion, as the name expresses, was used to mark the turn of the shadow at the solstices ; but the particular instrument invented by Ahaz was none of these ; because we know that his instrument was in the form of steps—and nothing could be better adapted for marking with precision the vertical movement or dip of the sun's shadow at noon.

Now a flight of steps must either be in the form of an inclined plane (the ascent of Ahaz), or circular as in the form of a cone, or a combination of inclined planes, as a pyramid. Amongst the horological instruments described by Vitruvius, we find the Cone, invented by Dionysiodorus; and the scholiast on a passage of Ptolemy's Geography describes the Sciotheron, or shadow-taker, in the form of a pyramid of four triangles, by which the meridian might be ascertained at any time or place. The pyramids of Egypt, as Herodotus tells us, were formed in steps called *Βωμίδας*, or little altars (perhaps to the sun), and we have an instance of a graduated pyramid in the British Museum, used in connexion with a dial. The dial is placed on a truncated pyramid, with seven steps of about three-quarters of an inch wide each, clearly intended for the purpose of marking the mid-day shadows, somewhat in this form:



Dial of the Roman Period, from Alexandria.

In the observatory at Pekin, when visited by Du Halde, an instrument, which may be called a Heliotropion of a simple form, was found, which is thus described: "They had contrived" (says P. le Comte), a Gnomon in a low room." . . "The slit which the ray of the sun came through, is about eight feet above the floor, is horizontal, and formed by two pieces of copper borne up in the air, which, by turning, may be set nearer or farther from each other, to enlarge or contract the aperture. Lower is a table with a brass plate in the middle, on which was drawn a meridian line 15 feet long, divided by transverse lines, which were neither finished nor very exact. There are some small channels round the table, for holding water, so as to level it."[1] Here is an exact description of a room, such as we may suppose to have been the dial-room of Ahaz, into which it may have been the daily habit of the king to retire for repose during the heat of the middle of the day.

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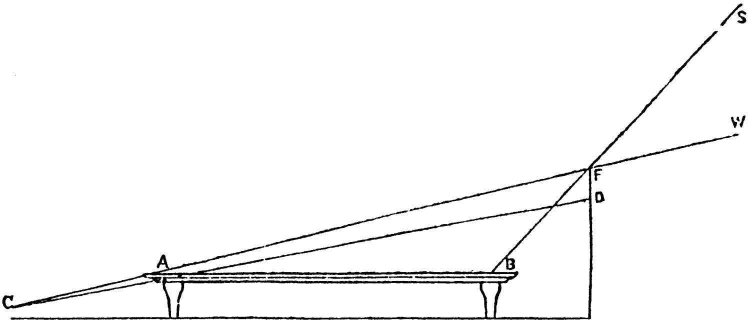
[1] Du Halde's "China," fol., 1741, vol. ii., p. 131.



Now, if A B represent the table placed in the line of the meridian, and F the aperture in the chamber above described, W the position of the sun at the winter solstice, and S its position at the summer solstice, it is clear that the shadow cast from the point F on the table would travel backwards and forwards between A and B, from winter to summer, and summer to winter. The defect, however, in the instrument is, the want of precision of the line of shadow on the table, caused by penumbra, preventing any very accurate observation of the position of the shadow at any particular moment. This defect would be in great measure cured by the substitution of the inclined plane C D, in place of the table, in the form of steps. By this simple improvement, each step becomes a second gnomon, defining the limits of shadow much more precisely, and enabling observations to be made with much greater accuracy. Such, I suggest, may have been the nature of the invention of Ahaz; or it may have been a small pyramidal flight of steps, moveable on the table, merely for observing the moment of the sun's dip at noon, like the common sextant. It is in vain to attempt to define the exact mode in which the phenomenon described was witnessed; but there is no difficulty in conceiving a mode in which it may have been witnessed by the king without moving from his couch.

I have now endeavoured to point out, how recently-discovered Assyrian inscriptions combine with the records of ancient history in determining the time of Sennacherib's invasion of Jerusalem to the year B.C. 689; how, therefore, we must look for a peculiar celestial phenomenon as having taken place in the beginning of that year;

and how it is found by pure science of astronomy that a phenomenon of the exact nature required, excepting only one particular, actually then took place. It only remains for astronomers to determine the exact time of central conjunction of sun and moon on the 11th of January in that year. For my own part, I have the greatest faith in the accuracy of the deductions to be drawn from the words of the sacred record, with regard to the time and form of the eclipse; and I venture to anticipate that astronomy will again be indebted to history for a test of her calculations, accepting from history the exact position of the shadow during the eclipse of B.C. 689, as on a recent occasion her calculations have been modified with a view to the historical position of the shadow during the eclipse witnessed by Agathocles in the year B.C. 310. Meanwhile, until the decisive authority of this exalted science shall be pronounced to the contrary, we cannot fail to recognize the striking connection between the event and the historical description; and to place the end of the third year of Sennacherib and the end of the thirteenth and beginning of the fourteenth year of Hezekiah in the year B.C. 689.